Stoller
Grand Junction Office established 1959

GJO-2003-543-TAC

299-E13-14 (A4726)
Log Data Report

Borehole Information:

Borehole: 299-E13-14 (A4726)			**Site:** 216-B-29 Trench		
Coordinates (WA State Plane)		**GWL (ft)[1]:** 343.2		**GWL Date:** 12/01/03	
North	**East**	**Drill Date**	**TOC[2] Elevation**	**Total Depth (ft)**	**Type**
134,474.13 m	573,087.50 m	Dec. 1956	228.237 m	369	Cable Tool

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Welded steel	2.75	6 5/8	6	5/16	+2.75	104
Welded steel	0	unknown	8	unknown	0	356
The logging engineer measured the casing stickup using a steel tape. A caliper was used to determine the outside 6-in. casing diameter. The caliper and inside casing diameter were measured using a steel tape. Measurements were rounded to the nearest 1/16 in. Casing thickness was calculated. Casing depths are from Ledgerwood (1993). The 8-in. casing is not visible at the ground surface.						

Borehole Notes:

Borehole coordinates, elevation, and well construction information are from measurements by Stoller field personnel, HWIS[3], and Ledgerwood (1993). Zero reference is the top of the 6-in. casing. Crushed grout is present on the ground surface.

Logging Equipment Information:

Logging System:	Gamma 1G		**Type:** 35% HPGe (34TP10967A)
Calibration Date:	4/2003	**Calibration Reference:**	GJO-2003-438-TAC
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	**1**	**2/Repeat**			
Date	12/01/03	12/01/03			
Logging Engineer	Spatz	Spatz			
Start Depth (ft)	100.0	25.0			
Finish Depth (ft)	3.0	15.0			
Count Time (sec)	200	200			
Live/Real	R	R			
Shield (Y/N)	N	N			
MSA Interval (ft)	1.0	1.0			
ft/min	N/A[4]	N/A			
Pre-Verification	AG025CAB	AG025CAB			

Log Run	1	2/Repeat			
Start File	AG025000	AG025098			
Finish File	AG025097	AG025108			
Post-Verification	AG025CAA	AG025CAA			
Depth Return Error (in.)	-1	0			
Comments	No fine-gain adjustment.	Repeat section.			

Logging Operation Notes:

Zero reference was top of the 6-in. casing. Logging was performed with a centralizer installed on the sonde. Pre- and post-survey verification measurements for the SGLS employed the Amersham KUT (^{40}K, ^{238}U, and ^{232}Th) verifier with serial number 118. During logging, fine-gain adjustments were not needed. Maximum logging depth achieved was 100 ft. Duratek well services reports that the borehole is blocked with tubing below 100 ft.

Analysis Notes:

Analyst:	Sobczyk	Date:	12/08/03	Reference:	GJO-HGLP 1.6.3, Rev. 0

SGLS pre-run and post-run verification spectra were collected at the beginning and end of the day. All of the verification spectra were within the acceptance criteria. The peak counts per second (cps) at the 609-keV, 1461-keV, and 2615-keV photopeaks on the post-run verification spectra as compared to the pre-run verification spectra for each day were between 2.3 percent higher and 5.3 percent higher at the end of the day. Examinations of spectra indicate that the detector functioned normally during logging, and the spectra are accepted.

Log spectra for the SGLS were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. The post-run verification spectrum was used to determine the energy and resolution calibration for processing the SGLS data using APTEC SUPERVISOR. Concentrations were calculated in EXCEL (source file: G1BMay03.xls), using parameters determined from analysis of recent calibration data. Zero reference was the top of the 6-in. casing. On the basis of Ledgerwood (1993), the casing configuration was assumed to be a string of 8-in. casing and 6-in. casing to the maximum depth of the logging (100 ft). Casing correction factors were calculated assuming a total casing thickness of 5/8 in. The casing correction is additive (e.g., 5/16 + 5/16 = 5/8 is the combined thickness for the 6-in. and 8-in. casings). Water and dead time corrections were not required.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (^{40}K, ^{238}U, and ^{232}Th), and man-made radionuclides. Plots of the repeat logs versus the original logs are included. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing correction. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. The ^{214}Bi peak at 1764 keV was used to determine the naturally occurring ^{238}U concentrations on the combination plot rather than the ^{214}Bi peak at 609 keV because it is less affected by the presence of radon in the borehole.

Results and Interpretations:

^{137}Cs was the only man-made radionuclide detected in this borehole. ^{137}Cs was detected at 27 ft with a concentration near the MDL (0.3 pCi/g). ^{137}Cs was also detected at 21 ft with a concentration near the MDL during the repeat log run.

The presence of grout has affected the KUT response in this borehole. Grout is present in the annulus between the casings to a depth of 104 ft. Grout is also present outside the 8-in. casing to a depth of 90 ft.

The behavior of the naturally occurring ^{238}U log (measured by ^{214}Bi) suggests that radon may be present inside the borehole casing. Determination of ^{238}U is based on measurement of gamma activity at 609 and/or 1764 keV associated with ^{214}Bi, under the assumption of secular equilibrium in the decay chain. However, ^{214}Bi is also a short-term daughter of ^{222}Rn. When radon is present, ^{214}Bi will tend to "plate" onto the casing wall and will quickly reach equilibrium with ^{222}Rn. Radon daughters such as ^{214}Bi may also "plate" onto the sonde itself. When this occurs, there is a gradual increase in total counts as well as photopeak counts associated with ^{214}Bi and ^{214}Pb. This phenomenon appears to best explain the observed discrepancy in ^{238}U values based on 609 keV between the original and repeat log runs.

The presence of radon is not an indication of man-made contamination; it is derived from decay of naturally occurring uranium. As a gas, radon moves easily in the subsurface, and concentrations of radon and its associated progeny can change quickly.

The plots of the repeat logs demonstrate reasonable repeatability of the SGLS data. Taking into account the effects of radon, the plots of the repeat logs demonstrate reasonable repeatability of the SGLS data for the natural radionuclides at energy levels of 1461 and 2614 keV. ^{137}Cs (based on 662 keV) was detected at 21 ft on the repeat log run while ^{137}Cs was not detected at 21 ft on the original SGLS log run.

Gross gamma logs from Additon et al. (1977) (attached) indicate that the sediments surrounding this borehole probably contained man-made radionuclides at 36 ft (11 m) from 1959 through 1968. The log from 5/3/76 appears to detect only background levels of gamma radiation. The SGLS detected only trace amounts of ^{137}Cs at 21 and 27 ft.

References:

Additon, M.K., K.R. Fecht, T.L. Jones, and G.V. Last, 1978. *Scintillation Probe Profiles From 200 East Area Crib Monitoring Well*s, RHO-LD-28, Rockwell Hanford Operations, Richland, Washington.

Ledgerwood, R.K., 1993. *Summaries of Well Construction Data and Field Observations for Existing 200-East Resource Protection Wells*, WHC-SD-ER-TI-007, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

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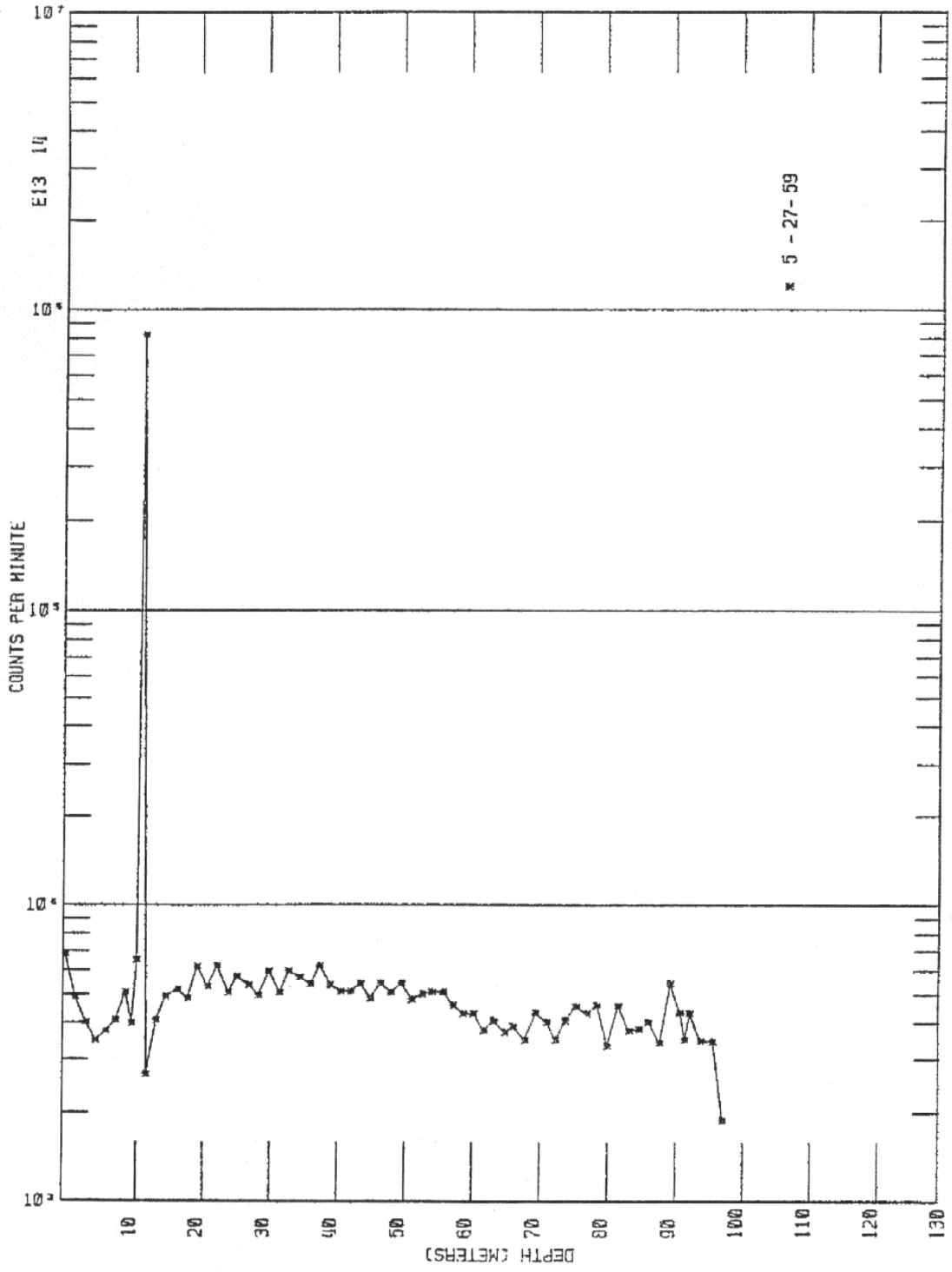
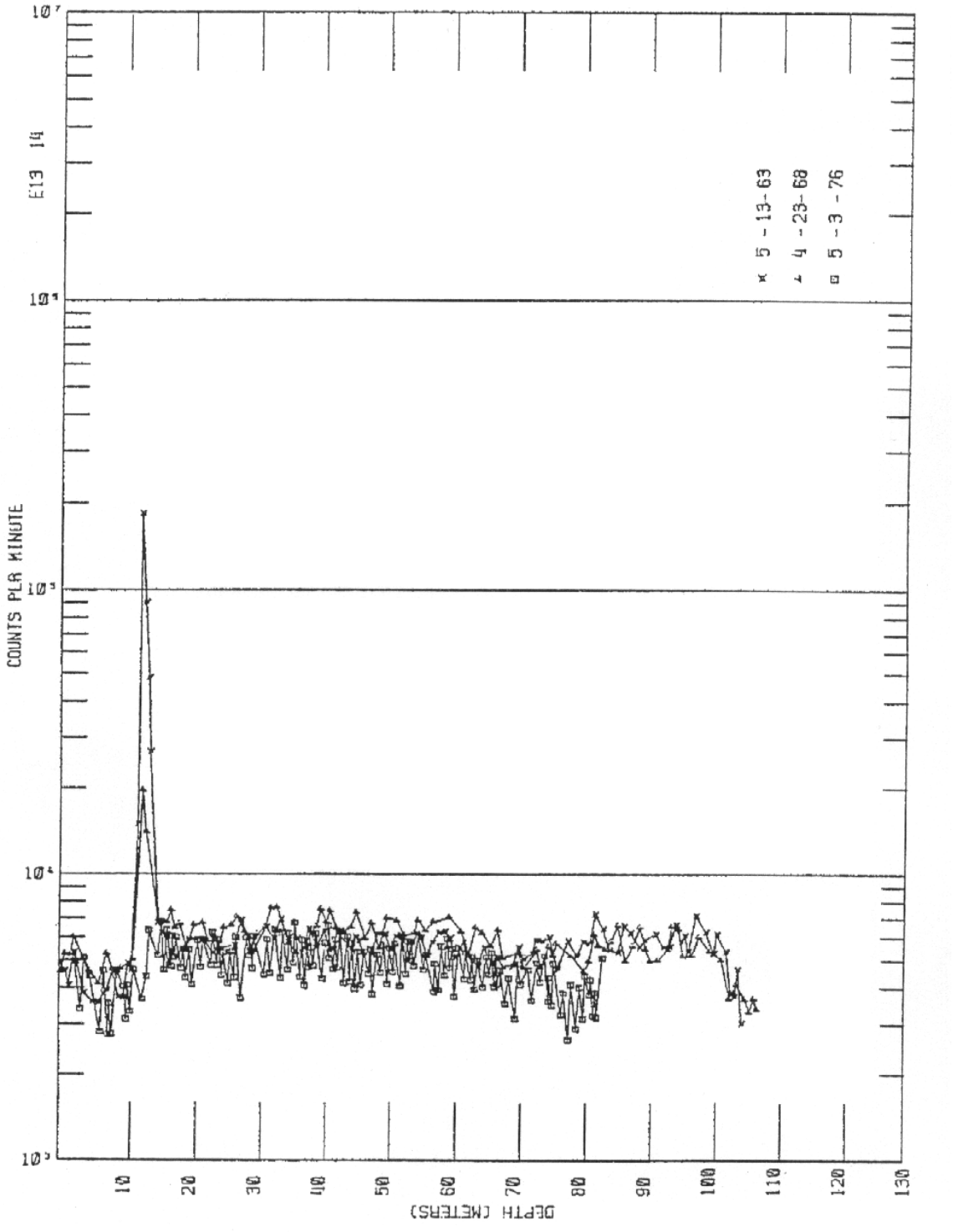
[1] GWL – groundwater level
[2] TOC – top of casing
[3] HWIS – Hanford Well Information System
[4] N/A – not applicable



from Additon et al. (1978)

Scintillation Probe Profile for Borehole 299-E13-14, Logged on 5/27/59



from Additon et al. (1978)

Scintillation Probe Profiles for Borehole 299-E13-14, Logged on 5/13/63, 4/23/68, and 5/3/76

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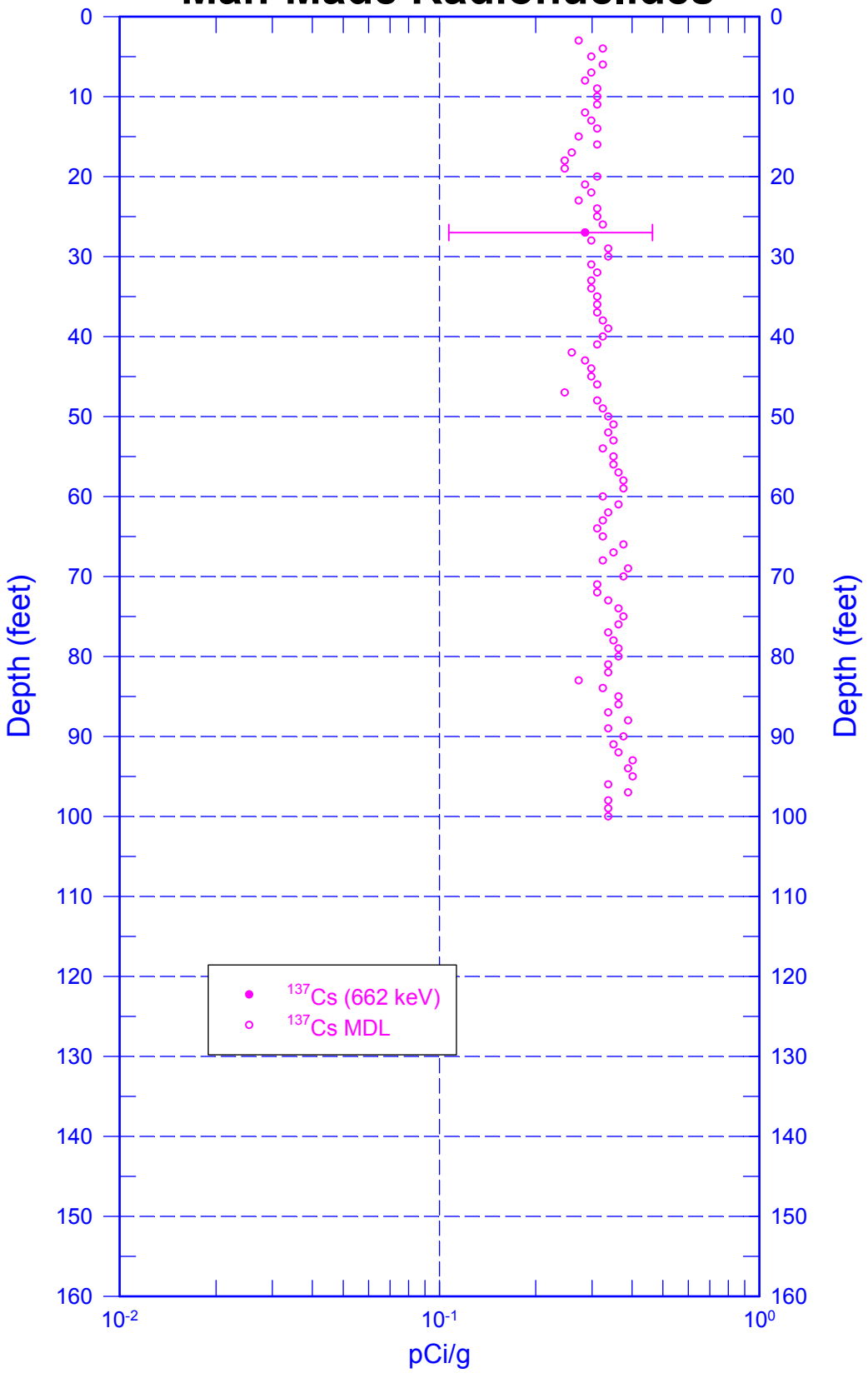
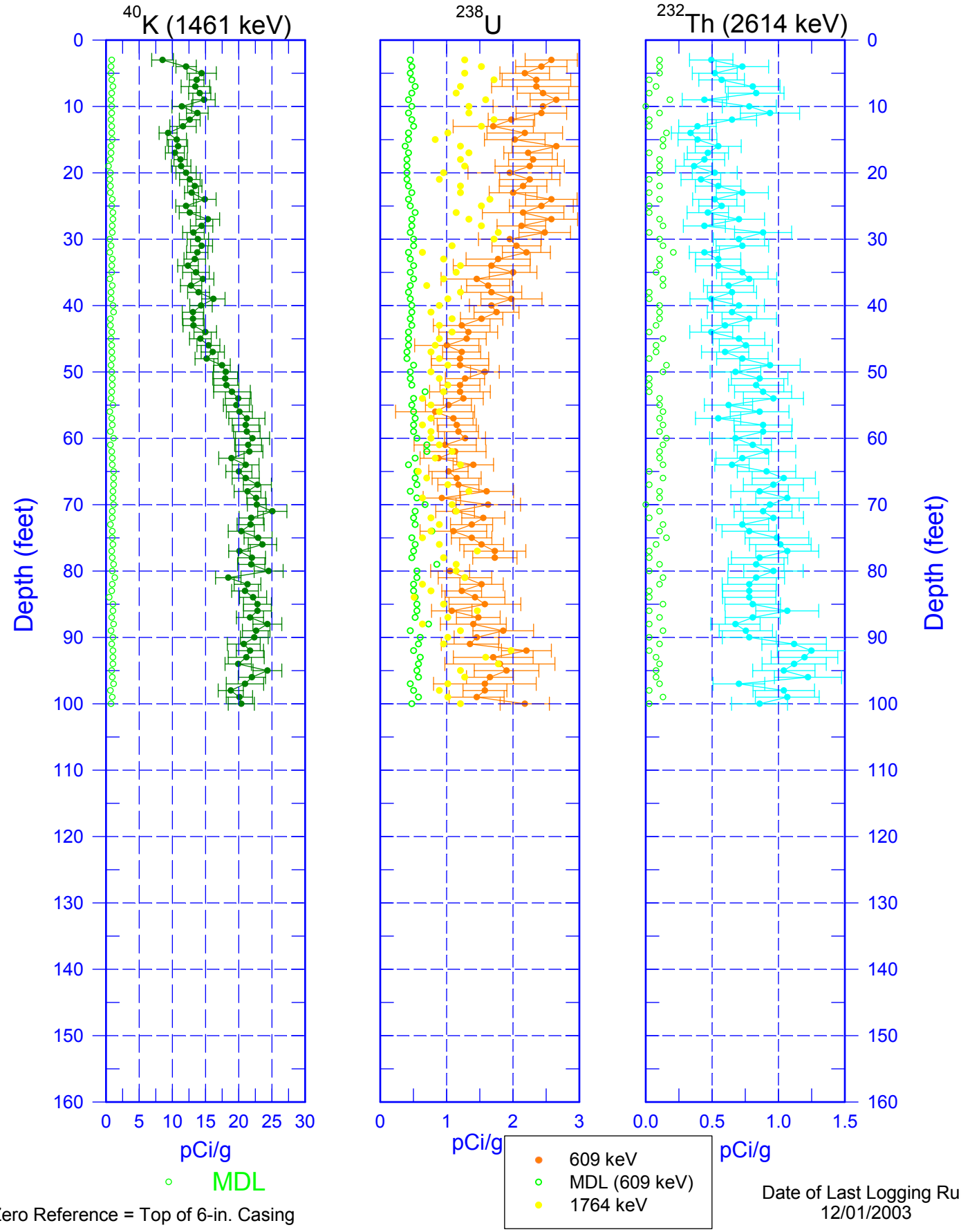
Man-Made Radionuclides



Zero Reference = Top of 6-in. Casing

Date of Last Logging Run
12/01/2003

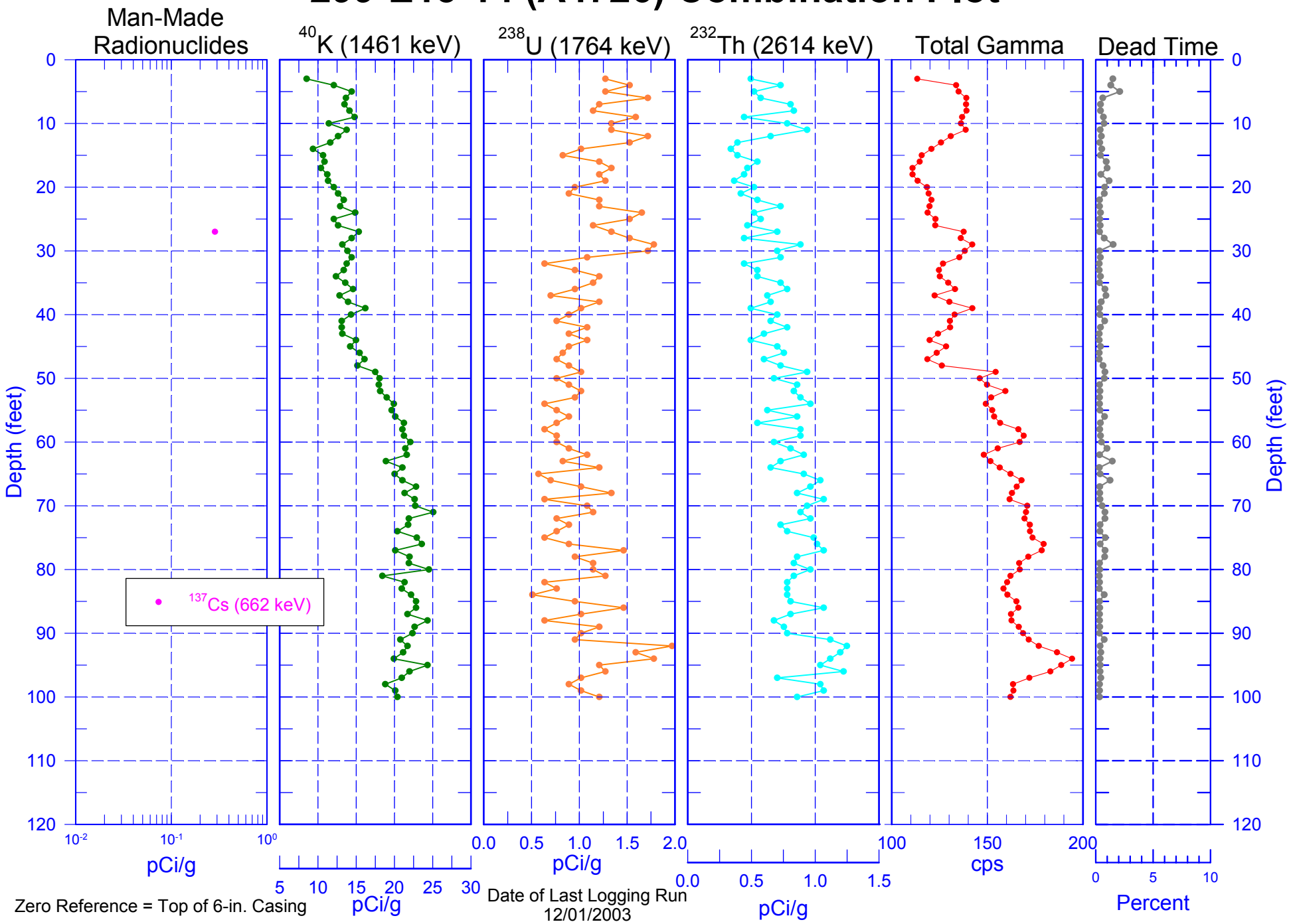
299-E13-14 (A4726)
Natural Gamma Logs



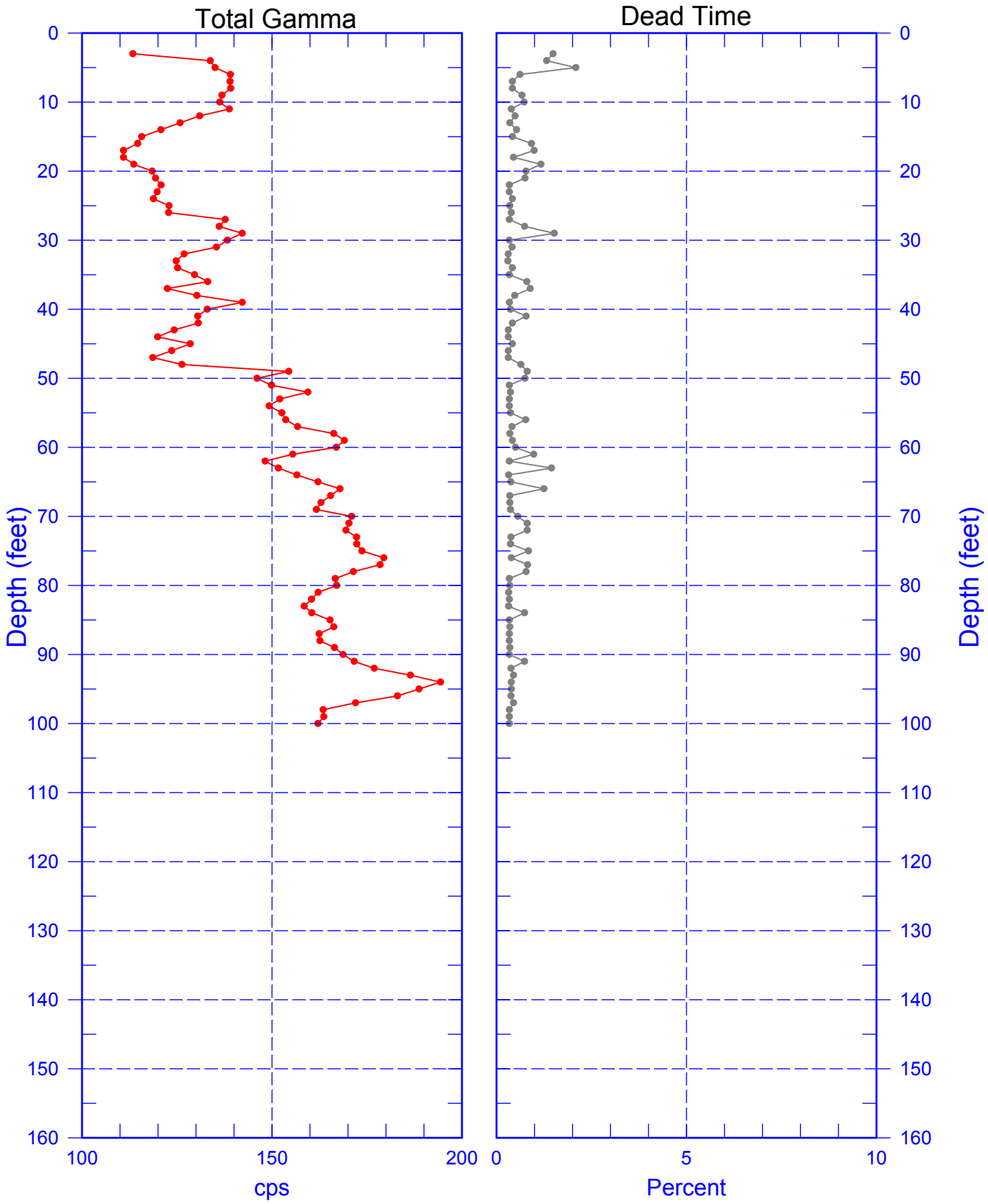
Zero Reference = Top of 6-in. Casing

Date of Last Logging Run
12/01/2003

299-E13-14 (A4726) Combination Plot



299-E13-14 (A4726)
Total Gamma & Dead Time



Zero Reference = Top of 6-in. Casing
Date of Last Logging Run
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Rerun of Natural Gamma Logs (25.0 to 15.0 ft)